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SMALL ISLANDS, NEW TECHNOLOGIES AND GLOBALIZATION: A CASE OF ICT ADOPTION BY SMES IN MAURITIUS

Kaushalesh Lal and Aveeraj Sharma Peedoly [#]

Abstract

This paper sets out to locate Mauritian SMEs in the present context of global competition and more particularly to identify the extent to which they have adopted ICTs as a tool to meet the challenges which they now face. The essence of the argument that comes to the fore is that despite having an impressive number of SMEs which contribute enormously to employment creation in the country, the latter are in many ways ill-equipped to confront the challenges of global competition. The findings clearly show that the adoption of ICTs in SMEs is far from being an integral feature of Mauritian SMEs despite recent claims to be a cyber-island. Cost of communication and the lack of learning opportunities have been found as the major impediments in the adoption of ICTs. In turn this raises serious implications and challenges for the SMEs themselves and the Government in order to adapt to the requirements of globalisation.

Keywords: Small Island Economies, ICTs, SMEs, Probit Analysis

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1. INTRODUCTION

Globalisation and (r)evolution of information and communication technologies (ICTs) are expected to change economic structure of nations. The expected superior economic structure is mainly influenced by the above two factors. In the literature the new structure is generally referred as Knowledge Economy, New Economy or E-conomy (Pohjola, 2002). Any change in economic structure cannot be visible unless the noticeable technological changes are experienced in two major components of an economy, i.e., manufacturing and service sectors. As is well known that small and medium-sized enterprises (SMEs) are major constituents of an economy, the organizational and technological changes in these firms are expected to have significant impact on national economies. Proponents of globalization argue that it will open a window of opportunities for SMEs while networking capabilities of ICTs suggest that SMEs can augment their competitiveness in global markets. In fact several studies (Lal, 2004, Drew, 2003) found positive impact of the adoption of ICTs by SMEs. Having no a priory knowledge of the impact of new technologies on small island economies, the present study seeks to examine the consequences of the adoption of ICTs by SMEs in Mauritius.

The positive link between SMEs and employment creation, poverty alleviation and economic growth is universally acknowledged (Beyene 2002). This fact is largely applicable to Mauritius as well, whichever definition of SMEs is adopted. Available evidence for *small businesses* alone which refer to businesses employing 9 or fewer workers in sectors other than agricultural activities, domestic services, Export Processing Zone (EPZ), Freeport and offshore operators and activities forbidden by law, clearly shows that in terms of their sheer number (75267 units)[1] representing 13.5% of GDP and employing nearly 36% of total employment, SMEs play a very important role in the Mauritian economy. If account is taken of small businesses in those other sectors and the medium enterprises, there is no doubt that the share of SMEs in employment, investment and output will be much higher. As Appanah (2003) argues if SMEs are defined as enterprises employing not more than 100 employees they would represent 80% of enterprises in Mauritius.

Paradoxically, until recently, the SME sector has been given relatively scant attention by Government. As Ramsurrun and Darymple (2002) argue, despite the fact that the Mauritian Government now recognizes that the real impetus of sustainable and equitable growth lies with SMEs, their development has been a largely neglected area in policy formulation and support.

[1] See CSO (2003) '2002 Collection of Statistics of Economic Activities' Central Statistics Office (2003)

In fact, the export-oriented industrial strategy which has been hailed as a remarkable success has been essentially concerned with attracting FDI flows and the growth of *large* enterprises. According to Wignaraja and O'neil (1999) underlying this strategy was an in-built assumption that SMEs growth and exporting would automatically follow. To a large extent therefore, the SME sector is today plagued by many problems that hamper their true potential.

More importantly with the onslaught of globalization, the challenges facing the SME sector are ever-growing and getting more and more complicated. With the liberalization of trade and commerce and the accompanying dismantling of trade preferences, SMEs are increasingly subject to severe competition from low-cost producing countries. On the other hand though, it is also clear that as the global economy continues to move towards increased integration as a result of advances in information and communications technology and the reduction in trade barriers, some of the greatest opportunities for SMEs will derive from their ability to participate in the regional and international markets.

SMEs flexibility and adaptability are key determinants to take advantage of the promises of globalisation. More particularly, usage of ICT, technology upgrading, and continuous innovation are paramount to being competitive and run at optimum efficiency. However there is relatively little empirical data pertaining to SMEs in Mauritius and more particularly regarding the extent to which they have adopted ICTs in day to day running of their businesses. This study therefore sets out to locate and analyse the Mauritian SMEs in the present socio-economic environment within which they evolve and more particularly on the basis of a quantitative survey, to assess the extent to which ICT is integrated in the day to day operation of SMEs.

Although there have been few studies (Wignaraja and O'Neil, 1999; SMIDO, 2004) that examined the problems and prospects of SMEs in Mauritius in the era of globalization, this study aims at analysing the adoption of new technologies and institutional support provided by the government. The focus of the study is on the degree of adoption of new technologies led by ICTs. The specific objectives of the study are:

To examine the level of ICT adoption by SMEs

To investigate the impact of ICTs in augmenting global competitiveness

To analyse the policy instruments aimed at SMEs

To identify and analyse factors that influenced the degree of the adoption of ICTs

The remainder of the paper is organized as follows: In Section 2 we review the historical background and economic contributions of SMEs while in Section 3 we delineate institutional support and policies aimed at better performance of SMEs. In Section 4 theoretical framework, methodology and statistical results are presented and discussed. Finally Section 5 contains summary and conclusion of the study.

2. DEFINITION OF SMES IN MAURITIUS

A review of academic and policy-oriented work on SMEs shows that there is a lack of consensus and considerable variations in how to define an SME, which in turn makes comparisons difficult over time as well as across and within countries thereby affecting the validity and/or reliability of the data. A discussion of how to define SMEs is beyond the scope of this work. However, it is clear that right at the outset, any analysis of SMEs in Mauritius is confronted to this contentious issue. For the purpose of this work the official definition of SMEs for Mauritius, which can also be referred to as the Small and Medium Industries Development Organisation (SMIDO[2]) definition and which is in terms of the size of fixed capital rather than the number of employees has been adopted:

> *SMEs are defined as enterprises engaged in manufacturing and using production equipment in their manufacturing process which includes transformation/conversion of raw materials, repair, packing, assembly of semi-finished parts into finished goods. The production equipment refers to equipment directly related to production. Such value of production should not exceed Rs[3] 5 million (SMIDO Act 1993)*

This definition has been revised to refer to manufacturing enterprises which use production equipment with an aggregate value of Rs 10 Million (SMIDO, 1998). This definition is an extension of the former definition of 'small-scale industry' (SSI) which according to the Small-Scale Industry Act of 1988, refers to a commercial enterprise which is engaged in 'manufacturing'[4] and which uses 'production equipment'[5] the aggregate CIF value of which does not exceed Rs 500, 000. The SMIDO definition has the important shortcoming of being very restrictive in the sense that non-manufacturing enterprises are not considered to be SMEs and as such do not qualify for the facilities and incentives which are offered to SMEs. For instance ICT SMEs or enterprises in the service, trade and financial sectors are antithetical to this definition especially at a time when these are the sectors which are gaining in importance with the gradual restructuring of the sugar and clothing sectors.

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[2] Currently the apex body to foster growth and development of SMEs

[3] Rs. stands for Mauritian Rupee

[4] Manufacturing here refers to the transformation for commercial purposes of raw materials or semi-processed materials into finished or semi-finished goods and can also include the repair, packing and assembly of inputs into finished or semi-finished goods

[5] Production equipment means machinery and equipment directly used in the process of manufacturing.

For such reasons, the few studies which have touched on SMEs in Mauritius (Wignaraja and O'neil 1999) have used different definitions. In addition available figures based on the SMIDO definition concern those SMEs that have registered with the SMIDO and as such they represent just a tiny fraction of the actual number. On the other hand, for the sake of simplicity and to avoid ambiguity, the Central Statistical Office (CSO) makes a basic distinction between small and large establishments irrespective of the industrial activity or size of fixed capital. According to the CSO, small establishments employ up to 9 workers while large establishments employ 10 or more workers. The advantages of adopting this definition are the availability of official figures due to the carrying out of regular censuses as well as the non-restrictiveness to specific industrial sectors. Both definitions are clearly indicated when used in this study.

2.1 Historical Background of SMEs

The *modern* SME which evokes the image of dynamic and market-led and export-oriented units, with a secure legal status and with access to institutional finance and run by a rational and efficient organizational structure and management lines is of fairly recent origin in Mauritius and is widely acknowledged to be the exception from the rule. As Pochun (1996) argues, for long the small scale industrial sector struggled to be recognized as a full fledged economic partner in the socio-economic development process. The concept SME in common parlance in Mauritius is itself of recent origin following the enactment of the SMIDO Act in 1993. Prior to 1993 the closest appellation was 'small scale industry'.

Although there is very little data pertaining to the evolution of SMEs across time, the origins of SMEs in Mauritius can be traced back to the 1960s when Mauritius was witnessing the beginning of a timid industrialization process with an import-substitution strategy with the main objective of supplying the local market and giving certain autonomy to the country. The inward-looking industrial policy of the Government of the day, which was the prevailing orthodoxy of the day especially for African developing economies was encouraging the production of such commodities as the manufacturing of blades, electrical bulbs, batteries, soap, welding and steel work for construction, refining edible oils, plastic industry, food canning, industrial poultry breeding, yogurt manufacturing, biscuits, shoes, matches etc for the domestic market. Many critics (see e.g Maujean, 1996) argue that this programme was superficially planned with no support schemes nor incentives proposed to the enterprises. Although, the import substitution strategy was soon overshadowed by an export-oriented strategy with the setting up of Export-Processing Zones, many small-scale enterprises exploited the products mentioned above for the domestic market. In fact, most SMEs today cater for the local market in similar areas as mentioned above.

According to Maujean (1996) the early enterprises were attempts to reproduce locally models which existed abroad. In food processing, firms like Purlait Ltd, La Boulangerie Industrielle and Lyons Maid which pioneered private, small-scale enterprises in the country started off with enormous difficulties in spite of being relatively modern with an important capital investment and sophisticated distribution network. The concern with survival in a largely traditional and poorly developed society meant that the local market was not yet ready for such products. Nevertheless against this background a protectionist strategy which involved high tariff against competitive goods helped these industries to operate.

In 1976 the Small Scale Industry Unit (SSIU) was established under the aegis of the then Ministry of Commerce and Industry and it carried out the first census survey of SSIs in 1978 (see Table 1 below). It also became the focal point in the ministry to provide general advice and guidance to small entrepreneurs.

Table 1: Small-scale industries in operation (1978)

Industry	Units	Employment
Garments, Leather Products	652	1860
Woodwork and cabinet making	241	620
Metal works and Electrical Repairs Workshop	179	540
Bakery	53	165
Jewellery	88	252
Printing	24	70
Motor/cyle Repair Workshops	198	426
Miscellaneous	128	335
Total	1563	4268

Source: SMIDO (1996)

The SSIU became the Small Industry Development Organisation (SIDO) in 1983 as it was increasingly being advocated that an apex organization with a legal framework for the SSI sector and an integrated policy approach were required. However it was in 1988 that the origins of conscious state policy towards SSI promotion are to be found following the enactment of the Small Scale Industries Act (1988) which provided for the promotion and development of small scale industries by adopting a legal definition of SSI, voluntary registration of SSI, duty exemption on production equipment and the setting up of an advisory board. The core elements of the definition of what constitutes an SME have remained largely unchanged until now as explained earlier.

The SMIDO Act in 1993, which was itself part of the Industrial Expansion Act of the same year was the next most important landmark in the promotion of SMEs. It established the SMIDO as a parastatal body with an expanded role to consolidate and further develop a modern SME sector in the country. The contribution of the SMIDO is further explored below.

2.2 Growth of SMEs and their Contribution to the Mauritian Economy

The absence of a definitive set of figures on the evolution of SMEs, more particularly the absence of directly comparable data i.e. data based on exactly the same conceptual and methodological definitions would inevitably make it a flawed exercise to plot the evolution of SMEs in terms of employment creation and contribution to the national economy. As explained earlier, the official definition of SMEs adopted by the SMIDO is itself very narrow and restrictive and even more so because its set of figures is based only on SMEs that are registered with this organization. For these reasons available figures from the SMIDO on registered SMEs (Tables 2) should be viewed with caution as they can be far from the real (but unavailable) figures.

Table 2: SME units, employment and investment by sectors

Sector	Number of units				Employment	Investment (Rs. Million)
	2001	2002	2003	2004	2004	2004
Food and Beverages	414	438	454	459	3628	382,248,068
Leather and Garments	325	336	355	360	4060	128,567,312
Wood and Furniture	341	352	359	363	2442	74,745,900
Paper Products and Printing	151	154	161	163	1036	157,476,599
Chemical,Rubber and Plastic	131	134	139	140	1192	124,732,525
Pottery and Ceramic	12	12	12	12	49	1,402,660
Jewellery and Related Items	86	89	95	95	505	25,459,585
Fabricated Metal Products	237	252	263	268	2224	115,338,154
Others	222	243	258	259	1806	135,444,340
Total	1919	2010	2096	2119	16942	1,145,415,143

Table 2 provides a sectoral distribution of SME units registered with SMIDO for given years. It is clear from these trends that over the last 4 years, apart from the pottery and ceramic sub-sector which has remained unchanged, the growth of firms in other sectors has been positive. Available estimates as of March 2004 reveal that in the registered SMEs, a total of nearly 17000 persons were employed and in all amounted to nearly Rs 1.15 Billion which represented about 0.6% of GDP at market prices for 2004.

2.2.1 Small Establishments and Employment Creation

If figures from the Central Statistics Office on small establishments as defined earlier are taken into account, the trends over the last 3 decades are truly impressive both in terms of the sheer number of units that have emerged and in terms of employment and income generated. The following table plots these trends. In the period from 1985 to present day the number of small establishments and employment generated have increased steadily and multiplied by more than

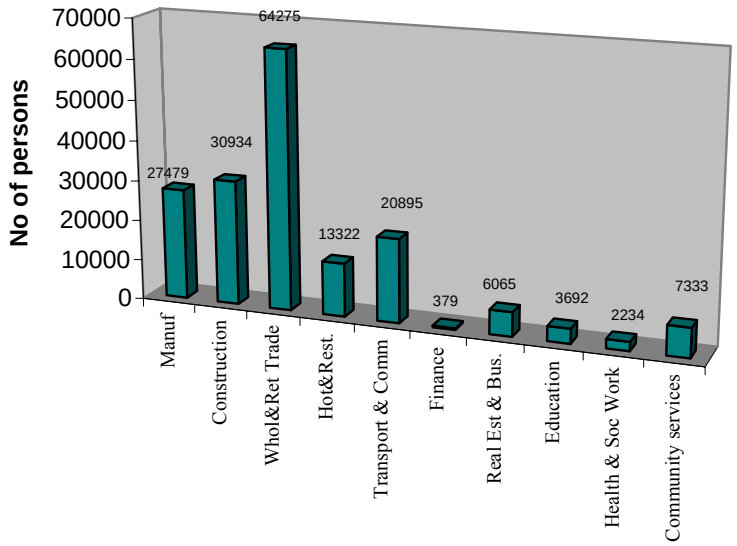
fourfold. It is estimated that the small establishments now employ 36% of the labour force. This highlights the evidence of a vibrant private sector enterprise culture.

Table 3: Performance of small businesses

Selected Years	No of small establishments	Total Employment	% of Labour Force
1985[6]	16000	47608	22%
1992[7]	40497	113274	24%
2002[8]	75267	200000	36%

The 2002 Collection of Statistics of Economic Activities by the CSO provides a breakdown of the number of persons that are employed in the various sectors in which small businesses thrive (Fig. 1). The majority of people are employed in the Wholesale and Retail Trade (64275), followed by construction and the manufacturing sectors which employ 30974 and 27479 people respectively.

Fig. 1: Sectoral employment by small business units in 2002



[6] CSO (1985) Census of small establishments
[7] CSO (1992) Census of economic activities
[8] CSO (2003) 2002 Collection of Statistics of Economic Activities

2.2.2 Small Establishments and Investment

According to the 2002 Census of Economic Activities, small units invested a total value of Rs 1.6 billion representing 5.2% of national investment. The highest investment was made by enterprises in the wholesale and retail trade which accounted for 45% of total investment made by all small establishments. Enterprises in the manufacturing sector accounted for only 6% of total investment made by all small establishments. In fact, conversely to their preponderant and ever-growing role in employment creation, the contribution of SMEs in terms of investment and contribution to national income lags far behind large establishments. This is clear from an analysis of the trends for available data[9] which shows that from a contribution of Rs 8261 million as value added representing 21% of GDP in 1992, small businesses contributed Rs 16.9 billion as value added in 2002 which represented 13.5% of GDP in 2002.

2.2.3 SMEs and Exports

There is hardly any data on the contribution of SMEs to exports. However, it is generally acknowledged that the contribution of SMEs in exports is very minimal. According to official figures only 2.2% of total exports are affected by SMEs (ITC, 2004). In fact this has been an ever-growing cause of concern for the Mauritian Government, the SMIDO and other organizations which operate with the view of exploiting the potential of local SMEs. An analysis of the institutional support which targets SMEs, as explained in more detail below shows that there are various measures being taken in order to make SMEs more globally competitive and export-oriented.

One of the principal exports of the country, textiles which have been intricately linked with the Global Commodity Chain (Gibbon, 2000), have involved the manufacture of basics by exclusively *large* firms based in Mauritius for exports to internationally famous brand names over Europe and the United States where the value-added would take place. Principally because of the economies of scale involved and resource constraints, SMEs have by and large been marginalized when it came to exporting. In addition it is also generally acknowledged that there is hardly any subcontracting and outsourcing from large firms to smaller ones. In short, when looking at the faint link between SMEs and exports, it is clear that SMEs play, as yet a negligible role in the global commodity chain network.

[9] based on the 1992 CSO Census of Economic Activities of Small Establishments and Itinerant Units and the 2002 Collection of Statistics of Economic Activities

3. INSTITUTIONAL SUPPORT AND SMES

As Wignaraja and O'neil (1999) argue, for the size of the country and its stage of development, Mauritius has a particularly wide range of support services for the SME sector. Beyene (2002) makes a largely similar argument especially when looking at it by African standards. This wide array of support is provided mainly through Government and parastatal agencies or financial institutions. The SMIDO, Mauritius Industrial Development Authority (MIDA), Export Processing Zone Development Authority (EPZDA), the Development Bank of Mauritius Ltd (DBM), National Computer Board (NCB) are generally regarded as the main institutions which provide support to SMEs by operating schemes to enhance the setting up or development of enterprises. They act mainly as facilitators, providing financial support, training and consultancy services, marketing and export assistance.

3.1 Small and Medium Industry Development Organisation

As mentioned earlier, the SMIDO which operates since 1993 is the apex organization for local SMEs which may or may not be actively engaged in exporting. Its mission is precisely to provide a wide array of institutional support services to SMEs with a major thrust on developing the competitiveness of SMEs in order to create a modern, strong, efficient and export-oriented SME sector in Mauritius. Registration with SMIDO which is encouraged but not compulsory enables registered SMEs to be exempted from the payment of duties or levies on the importation of production equipment as well as access to a range of services such as Business facilitation and Counseling, Training, Consultancy and Benchmarking, Export Assistance Scheme, Clustering and Business Incubators.

3.2 Mauritius Industrial Development Authority

MIDA is the focal point for the promotion of goods and services from Mauritius to overseas markets and has for mission to position Mauritius as a world class export hub. MIDA also constructs and manages industrial estates in Mauritius. Although its objectives concern all industrial sectors, it does have specific support programmes for the SME sector. Together with a programme to integrate SMEs, which are export-ready, in its export promotion activities, it operates an SME Export Business Support Scheme which aims to help eligible companies financially. The following indicates the main support services provided exclusively to SMEs by MIDA. Main services provided by MIDA are: Export business support scheme, SME exhibition

centre virtual exhibition centre, Industrial buildings/estates, Overseas market testing, Assistance, and Advice and information.

3.3 Export Processing Zone Development Authority

The EPZDA is a parastatal institution set up in 1992 to "ensure a smooth and successful transition at a time when Mauritius was embarking on a new phase of its industrial development''[10] which involved a shift from a labour-abundant to a skills-intensive economy requiring specialization, quality products, improved delivery times and creativity in product design amongst other things. The EPZDA has therefore been backing all export development activities to sharpen their competitive edge in order to face international competition.

With textile as the main axis of export development in Mauritius, most of the companies registered with the EPZDA are hence in the textile industry and are more likely to be large firms according to the national definition of SMEs. A broad range of services are provided to those firms, namely consultancy, training, seminars, research and development, exhibitions, trend forum and publications amongst others, with the view to learn about more efficient and latest technology, more particularly for the clothing industry.

However to what extent these directly help SMEs to orient themselves towards the export market is debatable as the number of SMEs which have successfully gained entry in the exports market is notoriously low.

3.4 Development Bank of Mauritius

An important part of the Bank's resources is geared towards the development, consolidation and modernization of the SME sector. A separate department at the DBM is in fact dedicated to promote entrepreneurship development. Loans are provided at competitive rates for start-ups, financing of production equipment, technology improvement and also for working capital with the maximum quantum allocated varying according to industrial sectors. With respect to exports, the DBM runs the Export Development Fund for participation in overseas trade fairs and market surveys and also provides loans for joint ventures with overseas partners. Together with the DBM, other commercial banks such as the Mauritius Post and Cooperative Bank (MPCB), the MCB and the STB offer credit facilities albeit at less competitive rates and relatively more important collaterals to small entrepreneurs. Recently most of the main banks in

[10] See URL: www.mauritius-industry.com

the country (MCCB, MCB, Barclays and the State Bank) have also announced preferential interest rates for SMEs.

3.5 National Computer Board

The NCB was set up as the apex organisation to develop and promote ICT and ICT-related services in Mauritius. Its main contribution towards SME development has been in terms of its incubator centre mainly for ICT start-ups with the main objectives of promoting entrepreneurship in the ICT sector by providing the necessary infrastructure and logistics, the development of linkages with other institutions and marketing. Moreover it runs sensitization programmes regularly for SMEs in order to familiarize and influence them to the strategic and financial benefits of integrating ICTs in the running of their enterprises.

3.6 Other SME Supporting Institutions

Together with the above institutions there are others, which mainly private sector bodies such as the Mauritius Employers Federation (MEF), and Mauritius Chamber of Commerce and Industry (MCCI) do provide miscellaneous facilities for SMEs more specifically in terms of documentation, training, advice and consultancy. Rather similarly to the above institutions except for SMIDO, they promote private sector industrial activity and development as a whole and indirectly touch on SMEs.

3.7 Institutional Support to SMEs: A Critique

Despite the variety of measures described above, it is acknowledged that the full potential of the SME sector has yet to be unleashed, the more so in the contemporary context of globalisation which calls for greater competitiveness and efficiency in both local and overseas markets. A review of the existing literature on the difficulties faced by the SME sector pinpoints the shortcomings of the existing support system. As Wignaraja and O'neil (1999:p 64) argue:

> *Undoubtedly the investment in SME support is not delivering the growth required or expected at the enterprise level and this must be improved. An overhaul of the entire support system is required to address the deficiencies (…) and to create a more cohesive integrated framework.*

According to them, among other things, the SME support system is plagued by a lack of coordination and a strategic perspective. The diversity of institutions and their relative autonomy contribute to a duplication of service while at the same time gaps exist in the provision to specific sectors – services, ICT and other emerging industries. The opportunities represented by the development of industrial sectors, the encouragement of upstream and downstream linkages and the role of indirect exporters remain largely unexploited. In terms of service provision, institutional support is criticized for its lack of targeting and direction. According to Wignaraja and O'neil (1999) resources are allocated on a first come, first-served basis to SMEs that request assistance rather than to those who exhibit the greatest potential for growth. Moreover, the underlying assumption that as long as SMEs are offered a menu of support activities they should be able to identify the help they need is inherently flawed: inexperienced entrepreneurs cannot know the precise nature of the most effective support.

It can be noted from above discussion on institutional support that no exclusive policy initiative has been taken by Mauritian government for diffusion of ICTs though the government is trying hard to make Mauritius as ICT hub for Africa. In the absence of any incentive for SMEs to adopt ICTs, predictably finding of the study suggest that the adoption of ICTs has not been disappointing. The results are presented and discussed in the following sub-sections.

4. METHODOLOGY AND STATISTICAL ANALYSIS

The section is divided into two parts. In first sub-section we discuss data sources and characteristics of sample firms while in second sub-section theoretical framework and the results of statistical analysis are presented.

4.1 Methodology and Data Sources

The sampling frame consists of a directory of registered SMEs in the country. This directory which is available from the SMIDO is a compilation of SMEs which accordingly fit the official criteria to be labeled as such. The obvious shortcoming was that this frame was very limited as registered SMEs can be considered to be the tip of the iceberg. On the other hand, this frame had the benefits of providing an up to date list of addresses and contact details, as well as a sectoral distribution of the registered SMEs which facilitated the fieldwork enormously. Survey, limited to 60 SMEs, was conducted between November 2004 and February 2005. We could not cover more firms due to resource constraints. Apart from being classified as SMEs, the sample enterprises were randomly selected from sectors which according to a SMIDO official who was interviewed prior to the fieldwork would in principle be more likely to adopt ICTs.

Appointments with the directors/owners of SMEs were booked over the phone beforehand and in turn a team of trained interviewers went to the respondents and administered the questionnaires face to face. Although 60 SMEs have actually participated in this survey, it is worthwhile to note that certain sections of the questionnaire have been generally problematical for the respondents. Firstly, there has been a marked reluctance to answer the questions regarding the financial details of the enterprise. In addition the whole section pertaining to foreign partnership has persistently been unanswered as it is simply not relevant in the local context especially in as much as SMEs are concerned. The following sub-section highlights the sectoral pattern of the adoption of various ICT tools.

4.1.1 Degree of ICT Adoption

Fifty-five percent of sample firms reported that they were using ICTs while remaining firms were not using them at all. However these figures should be interpreted with caution. In fact a deeper analysis shows that all firms in fact, do use ‘telephones’. Those firms that use only

telephones and no other ICTs have answered by the negative and therefore make up the 45 % referred to above. Table 4 (last row) shows the number of SMEs which use the given ICT tools. Tools such as Management Information System, CAD/CAM, CAE and Flexible manufacturing system were not only, unutilised in none of the selected firms but were equally unheard of in virtually all the firms surveyed.

An analysis of the usage of the main ICT tools (Table 4) i.e. Internet, Email and Numerically Controlled Machine Tools according to sector of activity reveals that the majority of firms in the printing sector (80%) make joint use of internet and email. Numerically controlled machine tools are used by all the sampled SMEs in the automotive sector. On the other hand, the garments sector make only moderate use of email and internet and significantly little use of numerically machine tools. The chemical, rubber and plastic sector makes poor use of these ICT tools across the board.

Table 4: Sectoral distribution of ICT use

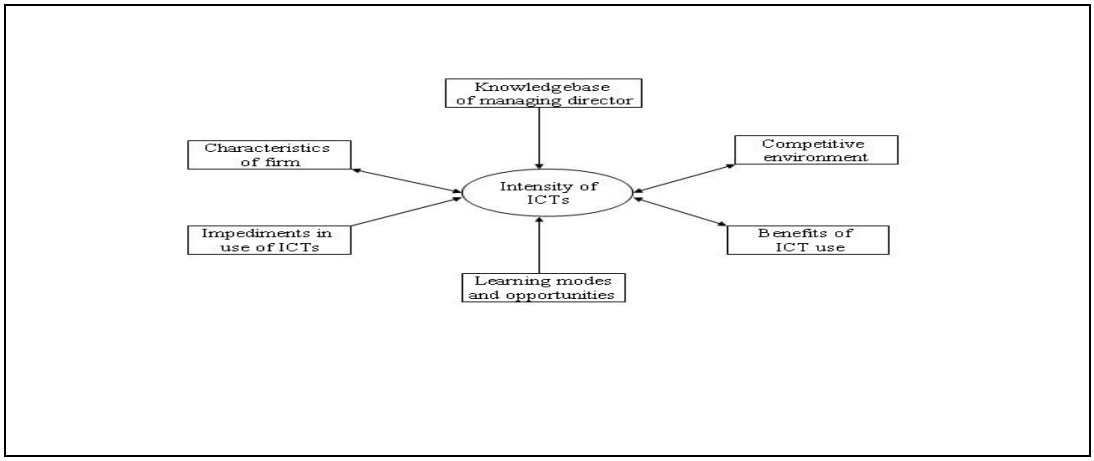
	Type of ICTs used				
Sectors	Email	Internet	Portal	Web-enabled technologies	NCMT
Garments	13 (41.9)	13 (41.9)	3 (9,7)	7 (22.6)	4 (12.9)
Chemical, Rubber and Plastic	2 (22.2)	2 (22.2)	1 (11.1)	1 (11.1)	1 (11.1)
Paper products and printing	8 (80.0)	8 (80.0)			3 (30.0)
Automotive	3 (30.0)	3 (30.0)	2 (20.0)	2 (20.0)	10 (100.0)
Total	26 (43.3)	26 (43.3)	6 (10.0)	10 (16.7)	18 (30.0)

Note: Figures in parentheses are percentage of users of a particular ICT tool.

4.2. Theoretical Framework and Statistical Analysis

The adoption of new technologies could be influenced by several independent are mutually reinforcing factors. These factors could be entrepreneurial abilities of owner, potential benefits of the new technology, learning opportunities for effective use, competitive environment, and affordability of new technologies. A theoretical framework depicting interaction among various factors is presented in Fig. 2.

Fig. 2: Theoretical framework



The direction of arrows in Fig. 2 shows the causality between the intensity of ICT adoption and a particular factor. For instance bidirectional arrow between degree of ICT use and competitive environment suggest that they mutually reinforce each other. Each factors depicted in Fig. 2 encompasses several variables. The variables included in the analysis and their definitions and measurements are as follows:

4.2.1 Knowledge base of Managing Directors

Managing directors' (MDs) academic qualification has been used as a proxy of this variable. Qualitative data about qualification of MDs were collected. However, it was converted into quantitative scale for the statistical analysis. MDs with primary education (23.7%) were assigned lowest rank, i.e., 1 while MDs (47.5%) having secondary certificate were given next rank, i.e. 2. Diploma holder MDs (13.6%) were assigned values 3 whereas degree holders (3.4%) were given highest rank, i.e. 4. MDs of seven firms (11.9%) did not disclose their qualifications. Such firms were excluded from multivariate analysis. We had to drop one outlier firms where the size of employment was 110 workers whereas the maximum employment in remaining firms was 47 workers.

4.2.2 General Characteristics of Firms

It was not possible to include a galaxy of variables representing characteristics of firms. Two variables, namely: size of employment which has been used as a proxy of size of firm, and age of firms have been included in the analysis. Existing literature (Lal, 2004; Lall, 1983) suggests that size has always played a critical role in the adoption of new technology. Having no a priory knowledge of the role of age of firm in the adoption of new technologies we hypothesize that older firms might have adopted more advanced technologies.

4.2.3 Impediments in ICT Use

There could be several impediments in the diffusion of ICTs such as cost, type, and speed of communication, Internet speed and associated costs, physical and technological infrastructure, and availability of appropriately trained manpower. Based on the empirical evidence available for other African countries (Oyelaran-Oyeyinka and Lal, 2005), we hypothesise that cost of communication could be the most important factors that resulted in varying degree of ICT adoption. Actually this is an opinion variables measured on a five-point scale ranging 1 for "not a constraint" to 5 for "severe constraint".

4.2.4 Mode of Learning

Literature on the learning processes suggests that there could be several modes of learning such as formal training, learning by doing, learning by searching, and learning from technical collaborators. This is also an opinion variable. MDs were requested to give their opinion on the effectiveness of this mode of knowledge acquisition. The opinion were sought on a five-point scale ranging 1 for 'not effective' to 5 for 'very good'. Learning processes have been found to be significant factor in knowledge acquisition in earlier studies (Doms et al, 1997; Oyelaran-Oyeyinka and Adeya, 2004). We also expect that MDs of advanced ICT using firms might have attributed more importance to learning by doing mode of knowledge acquisition.

4.2.5 Benefits of ICT Use

Although the list of benefits from the use of ICTs is very long, two variables, namely: productivity gains and efficiency in business transactions have been used in the analysis. Both the variables are opinion variables measured on a five-point scale ranging from 1 for "not beneficial' to 5 for 'most beneficial'. Findings of earlier studies suggest that firms in developing and developed countries adopted ICTs for productivity gains and efficiency. Kreamer and Dedrick (1994) perhaps for the first time found evidence of higher productivity of advanced ICT users. Lal (2002) study concludes that the use of advanced ICTs induced efficiency in business transactions. We also hypothesise that perception of MDs about benefits of ICT use might have resulted in different levels of ICT adoption.

4.2.6 Sources of Competitiveness

Three sources of competitiveness, namely; product quality, market network, and technological collaboration have been included in the analysis. Like most of the independent variables these variables were also measured on a five-point scale. Era of globalization is characterised by the international quality of product. Hence we expect that MDs who believed that one of the ways to face onslaught of global competitiveness is though the manufacture of high quality product might have adopted more advanced ICT tools. Technological collaboration is becoming increasingly important in SMEs also. Hence we expect that MDs of advanced ICT using firms might have assigned more importance to this source of competitiveness. Opinion of MDs on market network as a major source of competitiveness is expected to be significantly different in advanced ICT using firms from the rest.

4.2.7 ICT Intensity

Intensity of ICTs used by sample firms has been measured on three-point scale. First category of firms were those that were not using any kind ICTs. Percentage of such firms was 45.0 percent. Non-ICT using firms were given lowest rank, i.e.0. The second category of firms were those that were using ICT tolls in processes other than production. Such firms are labeled as IT-np firms and were assigned value 2. Sample firms that were using ICTs in production (NCMT) as well as non-production processes were assigned highest rank 3 and are labeled as IT-p firms.

Univariate analysis along with the level of significance of each variable is presented in Table 5. Results presented in Table 5 show that all other variables except age of firm and product quality as source of competitiveness differ significantly among three types of firms. Most important variables that differ significantly in advanced ICT using firms from the other are cost of communication, augmentation in productivity, and technological collaboration.

Table 5: Analysis of variance

Variables	IT-TYPE	Mean	F-value	Sig.
General Characteristics				
1.Education of owner (MDEDU)	ICT_no	1.73	2.432	0.098[c]
	ICT_np	2.29		
	ICT_p	2.00		
2. Total employees (SIZE)	ICT_no	6.50	3.954	0.025[b]
	ICT_np	6.40		
	ICT_p	13.78		
3. Age of firm in years (FIRM_AGE)	ICT_no	12.65	1.516	0.228
	ICT_np	11.13		
	ICT_p	16.11		
Impediments in ICT use				
4. Cost of communication (CoC)	ICT_no	4.48	10.717	0.000[a]
	ICT_np	3.33		
	ICT_p	3.67		
Mode of learning				
5. Learning by doing (LEARN)	ICT_no	2.58	4.978	0.010[b]
	ICT_np	3.14		
	ICT_p	3.89		
Benefits of ICT use				
6.Efficiency in production (EFFI)	ICT_no		5.385	0.027[b]
	ICT_np	2.00		
	ICT_p	2.33		
7. Increase in productivity (PROD_GAIN)	ICT_no	1.00	10.467	0.000[a]
	ICT_np	2.13		
	ICT_p	2.94		
Sources of competitiveness				
8. Technological collaboration (TECH_COL)	ICT_no	1.04	6.911	0.002[a]
	ICT_np	1.00		
	ICT_p	1.67		
9. Market network (MARK_NET)	ICT_no	1.77	2.662	0.079[c]
	ICT_np	3.07		
	ICT_p	2.47		
10. Product quality (PROD_QUAL)	ICT_no	4.62	0.730	0.486
	ICT_np	4.80		
	ICT_p	4.67		

Note: a→1 %, b→ 5%, and c→ 10% level of significance

Subsequently data were analysed in multivariate analysis framework. As can be noticed from earlier discussion that dependent variable, i.e. intensity of ICT use is an ordinal variable. Hence use of ordinary regression model will violate fundamental assumption of continuity of dependent variable. Therefore ordered probit model has been preferred. We have used LIMDEP econometric software which gives one constant and threshold parameter for index, that is, in a model specification of $z=\beta'x+\varepsilon$

$y=0$ if $z \leq 0$,

$y=1$ if $0 < z \leq \mu 1$, and

$y=2$ if $z > \mu 1$.

The results of probit analysis are presented in Table 6. As can be seen from the table that there are four different specifications of probit model have been used. This was imperative to tackle the multicollinearity problem among independent variables.

Table 6: Probit analysis

Independent Variables	Dependent variable: IT_TYPE			
	Eq. I	Eq. II	Eq. III	Eq. IV
Intercept	-0.930	1.673	-1.522	-0.374
MDEDU	0.352 (1.721)[c]			
SIZE		0.039 (2.044)[b]		
FIRM_AGE	0.033 (1.825)[c]			
COC		-0.409 (-2.334)[b]		
LEARN				0.351 (2.988)[a]
PROD_GAIN			0.405 (2.777)[a]	
TECH_COL			1.058 (1.716)[c]	
MARK_NET				0.195 (1.753)[c]
PROD_QUAL				-0.208 (-0.600)
Observations	52	53	52	55
Parameter (μ1)	0.738 (4.232)[a]	0.869 (3.842)[a]	0.979 (4.047)[a]	0.768 (4.194)[a]
Log Likelihood	-53.848 [0.099]	-50.696 [0.0007]	-46.014 [0.000]	-52.669 [0.005]

Note: Figures in parenthesis are Z values while in square brackets are level of significance of the function; a→1 %, b→ 5%, and c→ 10% level of significance

Table 6 shows that although academic background of MDs and size of firm have emerged significant in influencing the degree of the adoption of ICTs, the levels of significant are 10% and 5% respectively. These results are in accordance with our expectations. Although existing literature (Earl, 1989;; Cohen, 1995) suggests that these variables played an important role in the adoption of new technologies in large firms, the study perhaps for the first time found evidence of the critical role of entrepreneurs' knowledgebase and size in the adoption of ICTs in SMEs.

The emergence of the age of firm as a significant determinant is another unique contribution of this study. Technological change led by ICTs is regarded as paradigm shift and hence it is expected that the adoption of ICTs is path independent suggesting that the intensity of new technologies adopted by newer firms should be higher than the rest because newer firms do not have to dismantle the existing technologies. Positive sign of the coefficient of "age of firms" suggests that older firms were users of more advanced ICTs. The findings support the path independency theory of technological change. It could be justified in view of the technologies that have been included in this study. All the technologies are new and they do not require going in for "creative destruction".

The results also show that cost of communication played a decisive role in the intensity of ICTs used with 5% level of significance. This is in line with the existing literature (Hargittai, 1999).

The strange result is the negative sign of the coefficient. This is due to the method of measurement of the variable. As mentioned earlier importance of cost of communication in the adoption of ICTs was measured on a five-point scale. Lowest value, i.e. 1 was assigned to "not constraint" and highest value 5 was assigned to "sever constraint". Univariate analysis of COC suggests that merely 3.3 % MDs of sample firms opined that COC was not a constraint while 46.7% of MDs reported that COC was a sever constraint. Similar inference can be drawn from the results presented in Table 5. Table 5 shows that the average score of opinion (4.48) of MDs of non-IT using firms (rank 0) was higher that the average score (3.67) of advanced IT using firms (rank 2). The inverse relationship between ranking of firms based on ICT usages and the opinion of MDs is the cause of negative sign of the coefficient of COC in probit analysis.

The study also finds evidence to show that perception of MDs about productivity gains and technological collaboration significantly influenced the intensity of ICT adoption. The findings suggest that MDs who assigned more importance to productivity gains due to use of ICTs adopted more advanced ICTs. The finding is in accordance with our hypothesis and existing literature. There is ample empirical evidence in favour of the disappearance of 'productivity paradox' (Brynjolfsson and Hitt, 1996). Although most of the sample firms did not have foreign technological collaboration, MDs of advanced ICT using firms gave more importance to technological collaboration.

Emergence of opinion on product quality as an insignificant factor in influencing the degree of the adoption does not mean that MDs did not give any importance to this source of competitiveness. Statistically it has not emerged significant because most of MDs irrespective of the extent of ICTs adopted by their firms gave very high importance to the product quality. This is reflected from Table 5 which shows that average score of opinion varies from 4.62 by MDs of non-IT using firms to 4.67 by MDs of most advanced ICT using firm.

The study captures the significant role played by market network and learning by doing mode of skill upgradation. While the learning by doing mode of knowledge acquisition is very common practice in SMEs in developing countries, the role market network in influencing the degree of the adoption of ICTs is a new phenomenon. MDs of advanced ICT using firms might have given more importance to market network because sample firms are dominated by garments and paper product manufacturing sectors. Since buyers of these products are not regular particularly in the domestic market, firms need to have better market network so that their business can be sustained. Extensive use of ICTs can help firms in maintaining and expanding market network. Advanced ICTs using firms might have benefited from marketing aspect of business and hence they assigned more importance to market network factor.

5. CONCLUSION AND POLICY IMPLICATIONS

The general picture of Mauritian SMEs that emerges from the above findings is that the overwhelming majority are ill-equipped both literally and figuratively to cope with the challenges of globalization**.** The gradual demise of some of the economic pillars of the country in recent years triggered by contemporaneous ideological, economic and political realities of globalization and their accompanying effects on the unemployment rates are presenting at the one same time both a challenge and an opportunity for the SME sector. Focusing on the adoption of ICTs by local SMEs, it is clear from the findings of the study and also from available literature and interviews with Government officials who are responsible for providing support to SMEs, that Mauritius conforms to the norm of developing countries in the 'digital divide'. Whilst the sectors chosen should in principle reflect those sectors where SMEs would be more likely to have adopted ICTs, the results of the survey show that the ICTs used are severely limited.

Usage of more recent ICT tools such as Management Information Systems, CAD/CAM, CAE and flexible manufacturing systems were hardly known, let alone used by the firms surveyed. Only about a third of the sample makes regular use of the more common tools such as email and internet. Reasons for not using ICTs are predominantly the costs involved (not only in the purchase, installation and maintenance but also the communication costs and internet subscription fees), the lack of infrastructure for their use as well as their perceived little importance for the respondents trade. There is also evidence that a significant proportion of SMEs, as high as 33% are not aware of appropriate ICTs to be used and are unsure about the benefits of ICTs.

Conversely, only a small fraction of the SME population has developed or is developing into modern and competitive enterprises which can prove to be sustainable in the light of globalization. The recent aspirations of Mauritius to become a cyber-island and the ensuing massive investment in developing the ICT sector have yet to drive SMEs into adopting or upgrading their information and communications technology. In a way, the findings of this study about the extent of adoption of ICTs may well be justified by the relatively new development of the ICT sector itself in the country. Moreover, the predominance of local SMEs in inward-oriented, import substitution manufacturing activities, which caters mainly the domestic and local markets and their insulation from the competition that export-oriented (large) enterprises face on the world market, as well as a host of other factors such as access to finance,

expertise or the motivations of the entrepreneur are all issues which impact on the need, desire or ability of Mauritian SMEs to adopt ICTs.

Nevertheless, this slackness of SMEs in upgrading their technological infrastructure has important implications for their competitiveness and indeed survival in the context of globalization. In order to exploit the new opportunities provided under the Africa Growth Opportunity Act (AGOA), Southern African Development Community (SADC) and Common Market for Eastern and Southern Africa (COMESA), there is a dire need for modern and sophisticated SMEs which go beyond the traditional and oversaturated markets in which many SMEs tend to linger and exploit areas which have already been identified as having important potential – Footwear, Light engineering, tourism, Agro-industry, ICT and services. Such SMEs would not be competing on the basis of costs only and would require more emphasis on issues like quality, product design, value-added, delivery, after-sales service and reliability.

The widespread acknowledgement of the importance of the concept of 'innovation' for the competitiveness of SMEs is in fact intricately connected with ICTs. The benefits of ICTs per se notwithstanding, there is evidence which suggests that there is a long way to go before inculcating the values of innovation in the average small entrepreneur's jargon. Furthermore, energizing or modernizing the SME sector goes far beyond providing financial facilities/incentives to acquire or reduce costs associated with usage of ICTs. It requires perhaps a complete overhaul of the average entrepreneur's mindset and more investments in capacity-building. The findings of the study about the sources of competitiveness of the firm as well as the poor emphasis placed on human resource development and training policies illustrates such needs. It remains to be seen to what extent the impending policy initiatives in this direction through the setting up of the like of 'Enterprise Mauritius' and the 'Small Enterprise and Craft Development Authority' will go beyond the institutional support which is presently available and address those important challenges which may prove vital for the well-being of the local economy.

It is evident from findings of the study that government needs to provide marketing support to SMEs and also proactive programmes and policies for producing international quality of products by SMEs. This is imperative for existence of SMEs in the domestic market in the era of globalization. We have not been able to examine the economic performance of SMEs as a result of the adoption of ICTs due to lack of data on those indicators. More comprehensive survey is needed to accomplish that.

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Table A: Macroeconomic Indicators for Mauritius (2000-2004)

	Unit	2000	2001	2002	2003	2004
Population	Thousand	1186.9	1199.9	1210.2	1222.8	1233.7
GDP at market prices	Rs Million	119494	132092	141903	156906	174485
Per Capita GDP at market prices	Rs Million	100677	110086	117256	128317	140155
Real GDP Growth Rate	%	9.3	5.8	2.5	4.4	4.7
Inflation Rate	%	4.2	5.4	6.4	3.9	4.8
Budget Deficit to GDP at market prices	%	3.8	6.7	6	6.2	5.6
Internal Debt (Central Govt) to GDP at market prices	%	27.7	30.6	38.5	49.5	48.7
External Debt (Central Govt) to GDP at market prices	%	5.8	4.1	5	5.2	4.8
Debt service to exports	%	7.9	9.8	8.4	8.2	
Gross Domestic Fixed Capital Formation to GDP at market prices	%	26.9	25.4	25.1	25.9	25.7
Foreign Direct Investment Inflows	Rs Million	7265	292	1423	1966	1308
Unemployment Rate	%	8.8	9.1	9.8	10.2	
Trade						
Total Exports	Rs Million	40882	43628	43022	54164	
Of which						
Sugar Exports	Rs Million	5544	8557	8529	8430	
EPZ Exports	Rs Million	30961	33695	33502	32052	
Total Imports	Rs Million	54928	57940	64608	66384	
Tourist Earnings	Rs Million	14234	18166	18328	19397	
Ratio of Imports to Exports	1.34	1.33	1.5	1.23		

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